Feb. 27, 1945. E. W. CLARKE 2,370,450

KNITTED ARTICLE

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Fig. 2.

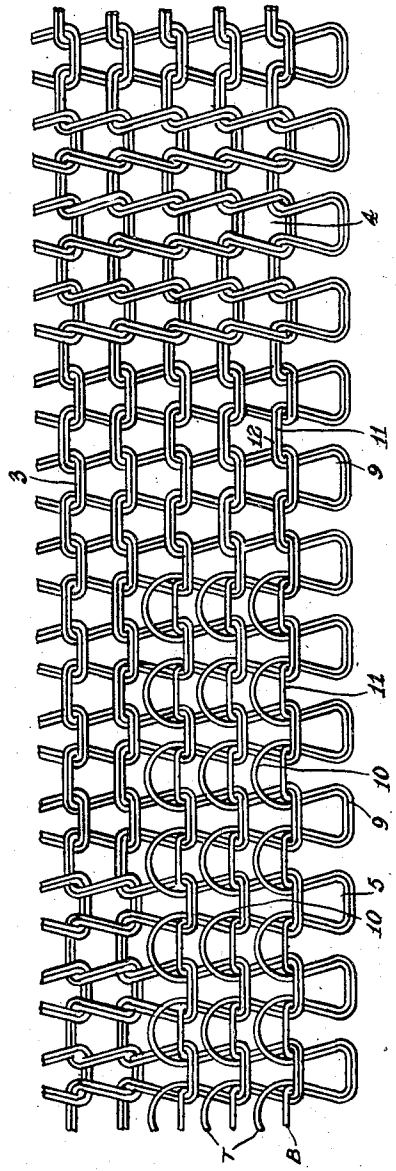
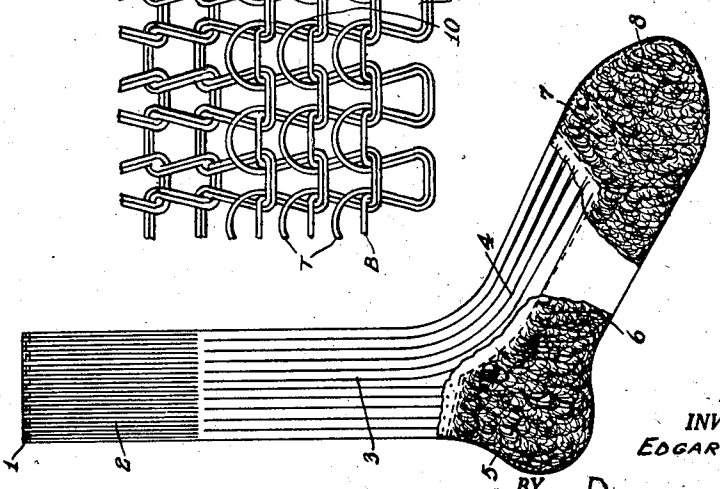


Fig. 1.



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Fig. 3.

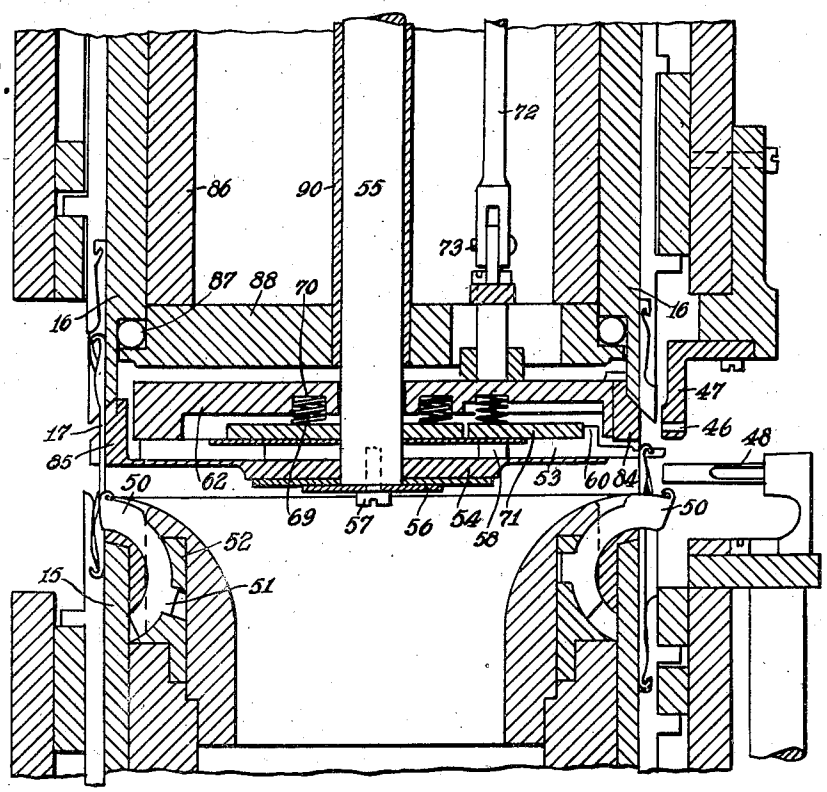
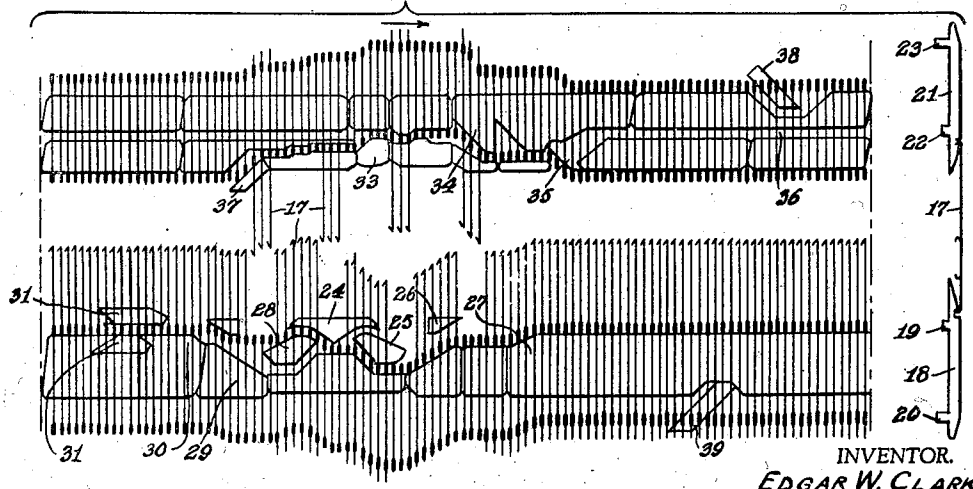


Fig. 4.



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Feb. 27, 1945. E. W. CLARKE 2,370,450

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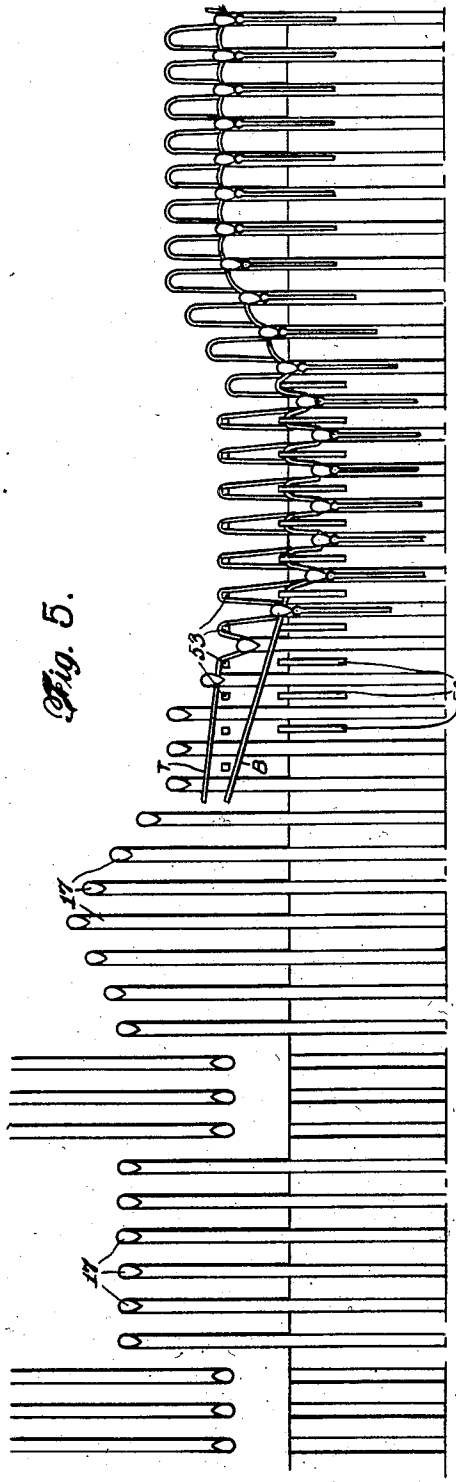


Fig. 5.

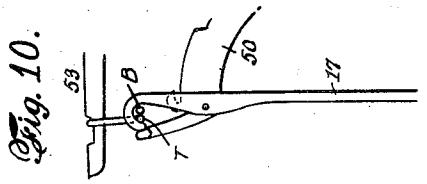


Fig. 10.

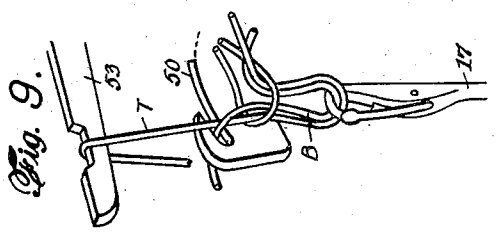


Fig. 9.

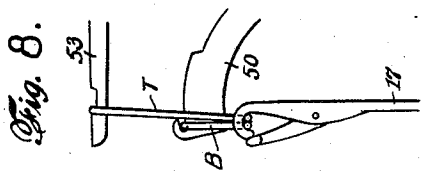


Fig. 8.

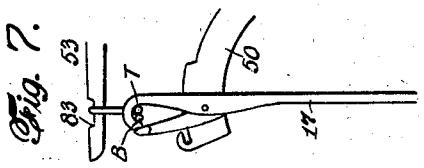


Fig. 7.

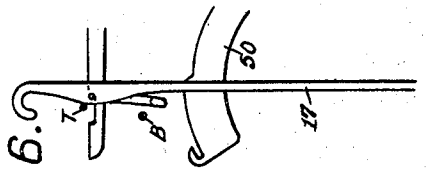


Fig. 6.

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Patented Feb. 27, 1945 2,370,450

UNITED STATES PATENT OFFICE

2,370,450

KNITTED ARTICLE

Edgar W. Clarke, Hamilton, Ontario, Canada, assignor to Interwoven Stocking Company, New Brunswick, N. J., a corporation of New Jersey

Application March 30, 1943, Serial No. 481,071

7 Claims. (Cl. 66—178)

My invention consists in the novel features hereinafter described, reference being had to the accompanying drawings which illustrate an embodiment of the same, selected by me for purposes of illustration, and the said invention is fully disclosed in the following description and claims.

My invention relates to knitting terry fabric. Such fabric is produced by feeding two threads to the needles of a knitting machine, and drawing longer loops of one thread than of the other, so that the long loops hereinafter referred to as terry loops protrude on one surface of the fabric and provide a soft cushioning effect. For example, the two threads may be fed to the needles and knitted with the needle loops of the threads in plated relation, but with the sinker loops of one thread longer than the corresponding sinker loops of the other thread to form the terry loops. The terry loops may or may not be combed or brushed so as to separate the fibres and commingle them in a soft matted condition on the surface of the fabric. The invention is particularly applicable to the knitting of articles of hosiery wherein the heel, sole and toe portions may be formed of terry fabric to provide greater softness and resiliency while the leg and instep may be formed of rib knit fabric including broad rib or Links-Links fabric.

It has heretofore been proposed to produce terry fabric by means of a circular knitting machine provided with sinkers having shoulders at different levels, the main knitting thread being drawn over a lower shoulder and the terry thread over a higher shoulder, whereby the sinker loops of the terry thread are longer than those of the main knitting thread and form the projecting loops of the terry fabric. The use of a two level sinker to produce terry fabric necessitates a change in the sinker wave, which may adversely affect the operation of the machine, for example in knitting portions of fabric where terry is not desired. Moreover, the length of the terry loops obtainable with this arrangement is strictly limited, particularly in a machine where there is a restricted space for operation of the sinkers, as in a machine having co-axial needle cylinders. A further difficulty encountered is that since the upper shoulder over which the terry thread is drawn and the lower shoulder over which the body thread is drawn are on the same sinker, they must necessarily be moved in or out together and hence movement of the sinker has to be a compromise between that desired for the long terry loops and that required for knitting the body thread. No independent movement of the two shoulders is possible.

It is an object of the present invention to overcome these difficulties and produce terry fabric having long terry loops and at the same time accurately control the plating of the body thread and the terry thread so that the desired thread will appear on the surface of the fabric. In accordance with my invention the terry loops are produced by instrumentalities located above the sinkers, and operated independently thereof, whereby the said instrumentalities can be moved in or out as desired, without interfering with the normal operation of the sinkers. These instrumentalities, hereinafter referred to generically as "bits," are adapted to project out between the needles in such manner as to separate a plurality of threads fed to the needles so that one thread is fed below the bits and another thread above the bits. Upon manipulation of the needles to receive and knit both of said threads, the sinker loops of one thread are drawn over the sinkers, while longer sinker loops of the other thread are drawn over the bits. The long loops of thread drawn over the bits constitute the terry loops of the fabric. Where reference is made to feeding one thread above the bits, and another thread below, it will be understood that additional threads may be fed to the needles, as desired.

The present invention makes it possible to produce longer terry loops on a coaxial cylinder knitting machine than could be obtained with special sinkers having shoulders at two levels. As the lower end of the upper cylinder must be spaced only a slight distance above the upper end of the lower cylinder to produce satisfactory rib fabric, the space between the two cylinders is strictly limited and prevents using sinkers having shoulders sufficiently spaced to produce long terry loops. However, by having terry forming bits associated with the upper cylinder, and cooperating with the needles operated in the lower cylinder to form the terry loops, loops of any desired length can be obtained. Moreover, the independent operation of the terry bits makes it possible to utilize them to separate the terry and the body threads and to control the accurate plating of these threads without interfering with the operation of the sinkers.

It is a further object of the invention to produce a knitted article having a portion composed of a plurality of threads knit to form terry fabric and an integral portion composed of the same threads knit to form rib knit fabric includ-

ing broad rib and Links-Links fabric. For example, an article of hosiery in accordance with my invention may have an anti-ravel edge, a top portion formed of rib knitting, leg and instep portions formed of rib knitting with a different stitch structure from the top, and heel, sole and toe portions of terry fabric. Further objects of my invention include producing a knitted article comprising a rib knit section and an integral terry section having long terry loops providing a soft, thick fabric; forming the terry loops of a continuous terry thread, thereby avoiding the loose ends incident to cutting an intermittently knitted thread and accurately controlling the plating of the thread in both the terry and the non-terry portions of the article to insure that the desired thread forms the outer face of the fabric.

Other objects and advantages of my invention will be understood from the following description and claims in conjunction with the accompanying drawings which illustrate an embodiment selected to illustrate the invention.

In the drawings,

Fig. 1 represents an article of hosiery made in accordance with my invention.

Fig. 2 represents on an enlarged scale the stitch structure of a section of fabric in said article.

Fig. 3 is a fragmentary vertical sectional view of a knitting machine for carrying out my invention.

Fig. 4 is a diagrammatic view showing the cams for operating the needles and sliders of said machine, the needles and sliders being shown schematically in side elevation at the right hand side of the figure.

Fig. 5 is a schematic view showing the operation of the needles, sinkers and bits in forming terry fabric.

Figs. 6 to 10 are fragmentary views illustrating diagrammatically the successive steps in forming the stitch structure of the fabric.

In Fig. 1 there is shown an article of hosiery produced in accordance with my invention and having an anti-ravel edge 1, a top portion 2 formed of rib knit fabric, a leg portion 3 and an instep portion 4, both formed of rib knit fabric which is preferably different from that of the top portion, and a heel portion 5, sole 6, toe band 7 and toe 8, all formed of terry fabric. The stitch structure of the fabric is shown in Fig. 2 wherein the upper portion of the figure represents a section of the leg 3; the lower left hand portion of the figure represents a section of the heel 5 and the lower right hand portion of the figure represents a section of the instep 4. The leg 3 and instep 4 are composed of rib knit non-terry fabric which is shown as 6 x 3 rib, but may be Links-Links or other rib knit fabric as desired, while the heel 5, together with the sole 6, toe band 7 and toe 8 are formed of plain knit terry fabric. By "plain knit" terry fabric is meant terry fabric in which all the needle loops are drawn to the same face of the fabric, as distinguished from rib knit fabric in which some of the needle loops are drawn to one face of the fabric, and other needle loops are drawn to the opposite face. In the terry portion of the fabric, a body thread B and a terry thread T are knitted in such manner that needle loops 9 are formed of both threads drawn together in plated relation, while the sinker loops are drawn separately so that the sinker loops 10 of the terry thread T are substantially longer than the sinker loops 11 of the body thread B and constitutes the terry loops of the fabric. The term "needle loop" is used herein to designate the lower portion of the stitch, i. e., the portion engaged by the needle in forming the stitch, while "sinker loop" is used to designate the upper part of the stitch, whether drawn over a sinker or other instrumentality. It will be seen that there is a terry loop 10 corresponding to each sinker loop 11 of the body thread B so that a dense, soft terry fabric is provided. To avoid obscuring the stitch structure, the terry loops are shown shorter than they would ordinarily be in carrying out my invention. Preferably, the terry loops should be at least twice as long as the sinker loops 11 of the body thread. In the instep portion 4 and the leg 3, the same threads B and T are knitted in plated relation to form rib knit non-terry fabric, i. e. the threads are drawn together so that corresponding loops of the respective threads are of substantially the same length. Hence, in the rib portion of the fabric, the sinker loops 12 of the terry thread T are of substantially the same length as the sinker loops 11 of the body thread B. The toe band 7 may be formed of terry fabric only on the sole half thereof, or all the way around as shown.

In knitting the socks shown on a circular knitting machine having superimposed coaxial cylinders, the top portion 2 is knitted with every other needle in the upper cylinder to produce a 1 x 1 rib or with different needle arrangements to produce any rib desired. Upon completion of the top portion, certain needles are transferred from one cylinder to the other to leave groups of six needles in the lower cylinder, alternating with groups of three needles in the upper cylinder. The needles operating in the lower cylinder form outwardly facing stitches constituting the outer ribs of the fabric, while the needles in the upper cylinder form inwardly facing stitches constituting the inner ribs. It will be understood that rib fabric other than 6 x 3 rib can be obtained by suitable transfer of the needles. When the upper portion of the heel 5 is reached, the needles on the "instep" side of the cylinder remain in position to continue rib knitting while consecutive needles on the "sole" side of the cylinder are all positioned on the lower cylinder, and the instrumentalities for forming the long terry loops come into operation to produce the terry fabric of the heel. The latter group of needles which up to this point have been producing rib knitting, must now produce terry fabric. Moreover, during the knitting of the sole 6 and instep 4, one group of needles knits terry fabric while another group of needles knits rib fabric so that part of each course is terry and the remainder is rib. Although the terry fabric thus extends only part way around the article, there are no loose ends of terry thread at the line where the terry fabric and rib fabric meet, and it is not necessary to cut and bind the terry thread in each course in passing from terry fabric to rib fabric since the terry thread is continuous and is knitted in plating relation with the body thread in the rib knit portion of the fabric. When the toe band 7 is reached, the needles on the instep side of the cylinder are transferred to the lower cylinder, and if it is desired to produce terry fabric all the way around the toe band, the terry bits on the instep side of the cylinder come into operation. The two groups of bits dispose respectively on the sole side and on the instep side of the cylinder, thus begin operation at different times. In knitting the heel

5 and toe 8, the machine is operated by oscillating the needle cylinders so as to knit first in one direction and then in the opposite direction. Both the body thread B and terry thread T are fed in each direction of rotation and are knit to form fabric having terry loops in each wale of each course so that a dense terry fabric is provided in the heel and toe portions.

In accordance with my invention, the plating of the two threads can be accurately controlled both in the terry and the non-terry portions of the fabric so that the desired thread forms the outer face of the fabric. For example, if a wool thread and a cotton thread are used, the wool thread can be made to form both the terry loops and also the outer face of the fabric so that the fabric has the appearance of being wool on both sides, while the cotton thread is concealed and forms a strong body for the fabric. Alternatively, the body thread can be made to form one face of the fabric, and the terry thread the other face. If desired, the plating may be varied in different portions of the fabric, for example, to obtain a design effect. Plating of the threads is accurately controlled by operation of the mechanism for forming the terry loops, as will be more fully explained below.

A knitting machine for producing articles in accordance with my invention is described and claimed in my co-pending application Serial No. 453,993. In Figs. 3 to 10 of the drawings, there is shown so much of the machine as is necessary to illustrate my invention. The invention is shown as being carried out on a knitting machine of the type in which superimposed coaxial needle cylinders are provided with needles having hooks at both ends, suitable transfer mechanism being also provided for shifting the needles from one cylinder to the other whereby all of the needles may be assembled in the lower cylinder for the production of circular plain knitting, or alternate needles or groups of needles may be transferred from the lower cylinder to the upper cylinder to produce rib knitting. The particular machine shown in the drawings is of the general type manufactured by William Spiers, Ltd., of Leicester, England, and certain parts which are not necessary to an understanding of the invention herein claimed have been omitted for the sake of clearness and succinctness.

The machine illustrated has a lower needle cylinder 15, an upper needle cylinder 16 and a circular series of needles 17 having a hook and latch at each end and operable in either cylinder (Figs. 3 and 4). When in the lower cylinder, the needles are operated by sliders 18 engaging the lower hooks of the needles, and having knitting butts 19 and transfer butts 20 adapted to engage needle operating cams. Preferably, the sliders operating the needles on the "sole" side of the cylinder, i. e., the side on which the heel, sole and toe of an article of hosiery are knit have short knitting butts while the sliders for needles on the opposite side of the cylinder, i. e., the "instep" side have long knitting butts. When the upper cylinder, the needles are operated by similar sliders 21 having knitting butts 22 and transfer butts 23 engaging suitable cams.

The cams for operating the needles are shown in Fig. 4 where the direction of movement of the needles and sliders relative to the cams when the machine is operated by continuous rotation is from left to right, as indicated by the arrow. The needles operating in the lower cylinder pass through a knitting wave as shown, being drawn down by center cam 24 and stitch cam 25 to draw loops of thread fed to the needles and cast off previously drawn stitches and being then raised by riser cam 26 and clearing cam 27 to a clearing position wherein the newly drawn loops are placed under the latch. When the cylinder is rotated in the opposite direction as when oscillated in knitting the heel and toe, the lower cylinder needles are drawn down by center cam 24 and a heel stitch cam 28 and are thereafter raised to clearing position by heel riser cam 29 and heel clearing cam 30. During the knitting of the heel and toe, the lower cylinder needles on the instep side of the cylinder, i. e., the long butt needles are raised by switch cams 31 to an inactive position in which they hold their stitches while the knitting butts of the respective sliders pass above center cam 24. The switch cams 31 are movable vertically from the inoperative position shown in Fig. 4 to a higher operative position for raising the long butt needles.

The cams for operating the needles in the upper cylinder comprise a stitch cam 33 and clearing cam 34. The upper cam block is also provided with a welt cam 35 which is withdrawn to allow the knitting butts of the sliders to pass through an idle track 36 so that the upper cylinder needles will hold their stitches without knitting during the knitting of welt courses on the lower cylinder needles, and with a switch cam 37 operable in conjunction with lower cylinder switch cams 31 to render the needles on the instep side of the cylinder inactive during the knitting of the heel and toe. There are also provided an upper transfer cam 38 and a lower transfer cam 39 which are movable inwardly and outwardly and act on transfer butts of different lengths to transfer needles from one cylinder to the other as desired.

The movable cams such as the transfer cams, welt cam and switch cams are moved into and out of operative position by suitable mechanism for example, under the control of a pattern drum which is intermittently racked around during the knitting of the article. As the control of such cams is well known in the art, it will not be described in further detail.

Adjacent the upper and lower stitch cams, there is provided a feeding station for feeding thread to the needles. At this feeding station the body thread B and terry thread T are fed in spaced relation so that the instrumentalities for forming the terry loops of the terry fabric can come between them and separate the two threads. In the particular arrangement shown, the feed for the terry thread T is provided by a hole or slot 46 in latch guard 47 and the feed for the body thread B comprises a feed finger 48 (Fig. 3).

The lower cylinder is provided with sinkers 50 (Fig. 3) or equivalent instrumentalities disposed between successive needles and adapted to cooperate with the needles in forming stitches. The sinkers are shown as having butts 51 which are acted on by sinker cam 52 to move the sinkers between an inner position shown at the left hand side of Fig. 3 and an outer position shown at the right hand side of said figure.

In accordance with my invention, the instrumentalities cooperating with the needles to form the long terry loops comprise a series of bits 53 (Fig. 3) associated with the upper cylinder. The bits 53 are located directly above the sinkers 50 so as to project out between successive needles when the needles are in position to receive thread fed at the feeding station. The relation of the

bits to the thread feeds is such that the bits project between the two threads so that the terry thread T is fed above the bits while the body thread B is fed below the bits and between the bits and the sinkers. Where reference is made to feeding one thread above and another thread below the bits, it is not necessary for one thread feed to be above and the other below the level of the bits, but only for the threads to be fed in at least slightly separated relation to one another and in such relation to the bits and needles that one thread is received above the bits and the other below. The needles operating in the lower cylinder are raised high enough to receive both the body thread B fed above the sinkers but below the bits and the terry thread T fed above the bits. When the needles are drawn down by the stitch cam, loops of body thread are drawn over the sinkers while loops of the terry thread are drawn over the bits, as shown in Figs. 5 to 9.

Fig. 5 represents diagrammatically the passage of the needles through the knitting wave, and shows how the terry thread T is fed to the needles above the bits while the body thread B is fed to the needles below the bits. Fig. 6 shows the relative positions of the needle, sinker, bits and threads at the feeding station. Fig. 7 shows a needle beginning to draw a loop of the terry thread over the bits **53** and receiving the body thread B in the hook of the needle. Fig. 8 shows the needle drawn down to draw a loop of the body thread over the sinkers and a much longer loop of the terry thread over the bits. Fig. 9 is a perspective view of the parts in the same position as in Fig. 8 and shows how the new stitch loop is drawn down through the previous stitch. It will be seen that the needle loops of the body thread B and the terry thread T are drawn in plating relation while the sinker loops are drawn separately with the sinker loops of the terry thread much longer than the sinker loops of the body being shown approximately twice as long. If desired, the sinkers **50** may be set lower to increase still further the difference in length of the terry loops and the sinker loops of the body thread.

The terry bits **53** are illustrated as being moved between an inner retracted position and an outer position in which the bits project out beyond the needle circle to separate the terry thread and the body thread as described above. The bits are moved out as they reach or approach the thread feeding station and are retracted to release the terry loops after loops of the terry thread and body thread have been drawn by the needles, as illustrated in Figs. 8 and 9. While the bits **53** or equivalent instrumentalities may be supported in any desired manner, they are shown as being carried by a dial **54** mounted adjacent the lower end of the upper cylinder, and hence above the upper end of the lower cylinder. In the arrangement shown, the dial is supported at the lower end of a shaft **55** extending down through the upper cylinder, being held on said shaft by washers **56** and screw **57**. The bit dial **54** is rotatable with the cylinder and is provided with radial grooves **58** in which the bits **53** are slidable in and out. If it is desired to knit terry fabric only in the heel, sole and toe portions of a sock, the bits **53** need be provided on only one side of the dial corresponding to the sole side of the needle cylinders as shown in Fig. 3.

As illustrated in Fig. 3, the bits **53** are projected and retracted by means of butts **60** engaging a cam track in a cam **62** located above the dial **54**. The cam **62** is held against rotary movement by being secured to shaft **55**. As the dial **54** carrying the bits **53** is rotated with the needle cylinder while the cam **62** is held against rotation, the bits **53** are moved in and out by action of the cam on the butts **60**. The cam **62** is positioned in predetermined angular relationship with respect to the feeding station to project and retract the bits at the proper time. Thus the terry forming instrumentalities **53** are inserted between the threads from inside the needle cylinder and are movable in and out independently of the sinkers. Optimum operation of both the sinkers and the bits **53** is hence possible.

When the needle cylinders are turned alternately in opposite directions as in knitting the heel and toe, the relative positions at which the bits are projected and the point at which the threads are fed to the needles must be shifted upon reversal of the direction of rotation to assure proper separation of the threads. In the arrangement shown in the drawings, this is accomplished quite simply by oscillating the bit cam **62** when the machine is operated by reciprocation. At its upper end and above the usual top plate of the machine, the shaft **55** carrying cam **62** is provided with a pair of arms adapted to engage a stationary buffer block. The angular spacing between the arms permits the shaft **55** and hence cam **62** to oscillate through a predetermined angle which is preferably adjustable. The cam is oscillated within the limits determined by said arms by providing a frictional drag between the cam and the needle cylinder or an element rotating therewith. As shown in Fig. 3, the cam **62** is provided with a friction plate **69** pressed against the upper face of the bit dial **54** by springs **70**. Upon reversal of the direction of rotation of the needle cylinders and dial **54**, the cam **62** is carried with the dial by friction plate **69** until stopped by one of said limiting arms.

In order to be able to knit non-terry fabric all around the cylinder, for example, in knitting the top or leg of a sock, provision is made for rendering the terry bits **53** inoperative. This may be accomplished by raising the bit cam **62** out of engagement with the butts **60** of the bits. In the arrangement shown in Fig. 3, cam **62** is provided with a movable section **71** which is raised instead of raising the whole cam. The means for raising the movable cam section from an operative position to an inoperative position is shown diagrammatically in Fig. 3 as a link **72** connected with pattern mechanism of the machine. The link **72** has a flexible joint **73** to permit oscillation of cam **62** as described above. The timing is such that cam section **71** is raised when the bits are in retracted position. Alternatively, the bits can be rendered ineffective to produce terry loops by shifting the relative position of the thread feeding station and the point at which the bits are projected so that the bits come out too late to separate the threads.

The bits **53** serve not only to form terry loops but also to control accurate plating of the threads. As will be seen from Figs. 5 and 6, the hook of the needle engages the terry thread T first and draws a partial loop thereof over bits **53** before the body thread B is engaged by the hook. By drawing the bit back slightly just as the hook of the needle engages the body thread the terry thread T is drawn to the back of the hook and when stitches are drawn will form the

outer face of the fabric. Alternatively, if the bit 53 is pushed out slightly as the hook engages the body thread B, the terry thread will be forced to the front of the hook (Fig. 10) so that thread B lies behind thread T, and the outer face of the fabric will hence be formed by the body thread B. Plating can thus be accurately controlled. The bits may be provided with notches 83 to give the bits a better purchase on the thread in controlling plating.

When needles are operated in the upper cylinder as occurs in knitting rib fabric, there must be provided a knocking over edge which serves the same purpose as the sinkers in the lower cylinder to engage the previously drawn stitches and cause them to be cast off when new loops are drawn by the needles. The lower edge of the upper cylinder wall ordinarily serves this function and is commonly referred to as a verge. The verge may be integral with the cylinder or may be in the form of a separate ring having needle grooves aligned with the needle grooves of the cylinder. As the terry bits 53 are preferably projected at a level above the lower edge of the verge, in order to form long terry loops the problem arises as to how to prevent interference between the bits and the verge. The problem is complicated by the fact that during the knitting of the sole and instep of a sock such as that shown in Fig. 1, the terry bits must be in operative position on one side of the needle cylinder to form a terry sole, while the verge must be in operative position on the other side of the cylinder to knit a ribbed instep. In the embodiment of the invention shown in the drawings, this problem is solved by splitting the verge into two sections so that the verge section 84 on the sole side of the cylinder can be raised out of the way of the bits while the verge section 85 on the instep side of the cylinder remains at proper level for producing rib knitting. As shown in Fig. 3, the verge section 84 is secured to or integral with the upper needle cylinder 16 which is rotatable about a bearing sleeve 86 and is supported by a vertical ball bearing 87 carried by a bearing plate 88. The bearing plate is secured to the lower end of a sleeve 90 which surrounds the vertical shaft 55 carrying the bit dial 54 and bit cam 62 and extends up through the top plate of the machine where it is connected with pattern controlled mechanism for moving said sleeve vertically. When the sleeve is moved to its upper position, the upper needle cylinder 16 and hence the attached verge section 84 on the sole side of the cylinder is raised up out of the way of the bits 53 so that the latter can be projected out to form terry loops (Fig. 3). However, during the knitting of the top and leg portions of the sock where there is no terry, the upper needle cylinder and verge section 84 are lowered so that the two sections of the verge are at the same level. It will be understood that the vertical movement of the upper needle cylinder does not affect the length of the stitches drawn, as the stitch length is controlled by the distance the needles are drawn up by stitch cam 33 which of course does not move with the cylinder.

The other verge section 85 is carried by the bit dial 54 and remains at a constant level. As the ends of verge section 85 abut the ends of verge section 84 carried by the upper needle cylinder, the bit dial 54 is made to rotate with the cylinder, and the needle grooves of the verge section 85 and of the cylinder are maintained in alignment. The split verge thus forms a simple and effective means for driving the bit dial 54 in synchronism with the needle cylinders. The height of the dial and hence of verge section 85 can be adjusted by vertical adjustment of shaft 55 by which the dial is carried in order to have the two sections of the verge at exactly the same level when verge section 84 is in its lower position. The adjustment of shaft 55 can also be used to change the length of the terry loops, it being understood that the length of the loops is determined by the distance the bits are located above the sinkers of the lower cylinder. In this event the vertical position of the upper needle cylinder carrying verge section 84 can also be adjusted to bring the two verge sections at the same level when knitting the top and leg.

If it is desired to knit terry all around the fabric, for example in the toe band of the sock shown in Fig. 1 instead of only on the sole half of the fabric, terry bits are provided all the way around the cylinder. It will be understood that in this event, provision must be made to avoid interference between the terry bits and the verge on the instep side of the cylinder. This may be done by making both sections of the verge raisable preferably independently, so that in knitting the sock of Fig. 1 the verge on the sole half of the cylinder can be raised when knitting the heel and sole while the verge on the instep side is not raised until the toe band 7 is reached. Alternatively, the verge portion of the cylinder wall may be apertured by cutting holes or notches therein so that the terry bits may come out through the cylinder wall. In some instances it may be desired to use the terry bits as a knocking over edge or verge for the upper cylinder needles, in which event the bits are manipulated so that the outer ends thereof are aligned with and substantially flush with the wall between the needle grooves of the cylinder at the knocking over point. With this arrangement the bits cooperate with the lower cylinder needles to form terry loops and cooperate with upper cylinder needles in the manner of a verge to cause previously drawn stitches to be cast off, thus serving a dual purpose.

The steps in making an article of hosiery such as that shown in Fig. 1 will be understood from a brief description of the operation of the machine. The socks are preferably produced by string work with a number of ravel courses of plain knit fabric referred to as a looper's edge between successive socks in the string. To produce the welt or anti-ravel edge 1, alternate needles are transferred to the upper cylinder and at least one course of 1 x 1 rib is knit. The welt cam 35 (Fig. 4) is withdrawn to render the upper cylinder needles inoperative, while a number of welt courses, for example, four or five are knit on lower cylinder needles only, whereupon the welt cam again goes in to close the welt and the knitting of 1 x 1 rib is resumed. The 1 x 1 rib knitting is continued until a sufficient length of the top portion 2 has been produced, whereupon the transfer cams 38 and 39 act on selected needles to position groups of six consecutive needles in the lower cylinder alternating with groups of three consecutive needles in the upper cylinder for the 6 x 3 fabric of the leg. During the knitting of the welt, top and leg, the terry bits 53 remain inactive.

When the heel portion 5 is reached, a needle transfer is effected so that on the sole side of the cylinder consecutive needles are positioned in the lower cylinder, while the needles on the instep side remain positioned for 6 x 3 rib. At

about the same time, the upper cylinder is raised to raise verge section 84 on the sole side of the cylinder, and the movable section 71 of bit operating cam 62 is lowered to operative position to cause the bits 53 to be projected out between the threads fed at the feeding station. Preferably one or more circular courses are knit before the needle circle begins oscillation to produce the fashioned portion of the heel. During the oscillation of the cylinder, the needles on the instep side of the cylinder are rendered inactive by control of the switch cams 31 and 37. When the heel is completed and circular knitting resumed, the switch cams are operated to cause needles on the instep side of the cylinder to resume knitting. During the knitting of the instep 4 and sole 6, the needles on the sole side of the cylinder cooperate with bits 53 to produce long terry loops of the terry thread T while on the instep side no bits are projected, and hence the body thread B and terry thread T are knitted in plated relation. This condition is represented in Fig. 5 where it will be seen that the needles at the right hand side of the figure are producing terry fabric, while the needles at the left hand side are positioned for producing the 6 x 3 knitting of the instep. When the toe band 7 is reached, all the remaining upper cylinder needles are transferred to the lower cylinder, and if it is desired to produce terry fabric all around the toe band, the bits on the instep side of the cylinder come into operation. The toe like the heel, is produced by reciprocation of the needle cylinder, using only the needles on the sole side of the cylinder, the needles and bits on the instep side being rendered inoperative. Upon completion of the toe, all of the terry bits 53 are retracted so that the machine will produce the plain knit looper's edge above referred to. Before going into the welt of the next sock, the upper cylinder and the attached section 84 of the verge are lowered to bring the two sections of the verge to the same level.

It will be seen that the invention thus provides a novel method of producing terry fabric whereby instrumentalities located above the needle cylinder and operated independently of the sinkers are projected between the needles to separate the terry thread and body thread and to cooperate with the needles in forming long terry loops and controlling plating.

What I claim and desire to secure by Letters Patent is:

1. A knitted article comprising a section of terry fabric composed of body thread and terry thread, said terry thread being knit in accurate plating relation with the body thread to form terry loops on one face of the fabric and also form the opposite face of the fabric, thereby concealing the body thread.

2. A knitted article comprising a section of terry fabric and an integral section of non-terry fabric, both composed of body thread and terry thread, said terry thread being knit in accurate plating relation with said body thread to form terry loops on one face of the fabric in said terry section and also form the opposite face of the fabric in both said terry section and said non-terry section.

3. A knitted article comprising a section of terry fabric and an integral section of rib knit fabric, both composed of body thread and terry thread knit in accurate plating relation, said terry thread forming terry loops on one face of the fabric in said terry section and also forming the opposite face of the fabric in both said terry section and said rib knit section.

4. A knitted article comprising a section of terry fabric and an integral section of rib knit fabric, both composed of body thread and terry thread, said terry thread being knit to form terry loops on one face of the fabric in said terry section and said body thread being knit in accurate plating relation with the terry thread to form the opposite face of the fabric in both said terry section and said rib knit section.

5. A knitted article comprising a section of terry fabric knit of body thread and terry thread, needle loops of said terry thread being disposed in accurate plating relation with needle loops of said body thread, and sinker loops of said terry thread being longer than sinker loops of said body thread, and forming terry loops of the fabric, and an integral rib knit section formed of said threads knit in plating relation with corresponding loops of the respective threads substantially the same length.

6. A tubular seamless article of hosiery comprising heel, sole and toe portions composed of a plurality of threads knit together to form plain knit terry fabric, one of said threads being knit to form loops which are substantially longer than corresponding loops of the other thread and which constitute the terry loops of said fabric, and integral leg and instep portions composed of the same threads knit together to form rib knit non-terry fabric in which corresponding loops of the respective threads are of substantially the same length.

7. A knitted article of hosiery comprising a tubular seamless leg section composed of a plurality of threads knit together to form rib knit non-terry fabric throughout the coursewise extent of said section, an integral section composed of said threads knit to form plain knit terry fabric throughout a part of the coursewise extent of said section to form a sole portion of said article and the same threads knit together to form rib knit non-terry fabric throughout the balance of the coursewise extent of said section to form an instep portion, and a further integral section composed of said threads knit to form plain knit terry fabric throughout the coursewise extent of said section to form a toe band portion of said article.

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